LifeKeeper® for Linux v4.5.0

Logical Volume Manager (LVM) Recovery Kit Administration Guide

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Address correspondence to:

ip@steeleye.com

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LVM Recovery Kit Administration Guide

Introduction

The LifeKeeper for Linux Logical Volume Manager (LVM) Recovery Kit provides logical volume support for other LifeKeeper recovery kits. Thus, LifeKeeper-protected applications can take advantage of the benefits offered by the Logical Volume Manager, including simplified storage management and the ability to dynamically re-size volumes as needs change.

The LVM Recovery Kit is different from most other LifeKeeper recovery kits in that it is never used alone, but always as a dependency of another LifeKeeper resource. As such, many of the operations typically associated with a LifeKeeper recovery kit – for example, creating a hierarchy – are not directly applicable to the LVM Recovery Kit.

Document Contents

This guide explains the following topics:

- **Documentation and References.** Provides a list of related LifeKeeper for Linux documents and where to find them, along with references to a number of helpful documents about the LVM product.
- **Requirements.** Describes the hardware and software necessary to properly setup, install, and operate the LVM Recovery Kit. Refer to the *LifeKeeper for Linux Planning and Installation Guide* for specific instructions on how to install or remove LifeKeeper for Linux software.
- **Overview.** Provides a general description of the LVM recovery kit and corresponding resource types.
- **LifeKeeper LVM Hierarchy Creation and Administration.** Includes a detailed description of LVM recovery kit administration tasks through LifeKeeper.
- **Troubleshooting.** Provides a list of informational and error messages with recommended solutions.

Documentation and References

The following LifeKeeper documentation is available from SteelEye Technology, Inc.:

- *LifeKeeper for Linux Release Notes*
- *LifeKeeper for Linux Online Product Manual* (available from the Help menu within the LifeKeeper GUI)
- *LifeKeeper for Linux Planning and Installation Guide*

This documentation, along with documentation associated with other LifeKeeper recovery kits, is available on the LifeKeeper Documentation CD that is shipped with your software.

The latest versions of LifeKeeper for Linux documentation are also provided on the SteelEye Technology, Inc. website at:

www.steeleye.com/support/documentation.

For information on LVM, refer to *LVM HowTo*, Revision 0.4, December 2002; AJ Lewis, Maintainer; Copyright ©2002 Sistina Software, Inc., available at tldp.org/HOWTO/LVM-HOWTO/

SuSE has also produced a very good technical white paper titled “The Logical Volume Manger” that is available at www.sistina.com/downloads/whitepapers/LVM_WP.pdf

Requirements

Your LifeKeeper configuration must meet the following requirements **prior** to the installation of the LifeKeeper for Linux LVM Recovery Kit. Please see the *LifeKeeper for Linux Planning and Installation Guide* for specific instructions regarding the configuration of your LifeKeeper hardware and software.

Hardware Requirements

- **Servers.** This recovery kit requires two or more computers configured in accordance with the requirements described in the *LifeKeeper Release Notes* and the *LifeKeeper Planning and Installation Guide*, which are shipped with the product media.
- **Data Storage.** The LVM Recovery Kit can be used in conjunction both with shared storage and with replicated storage provided by the LifeKeeper Data Replication product. It cannot be used with network attached storage (NAS). Otherwise, the kit has no specific requirements on storage configurations beyond the requirements of the recovery kit protecting the application sitting on top of the logical volume(s).

Software Requirements

- **Operating System.** LVM is included in all major Linux distributions. See the *LifeKeeper Release Notes* for a list of supported distributions and LVM versions.
- **Logical Volume Manager.** The recovery kit installation requires that the **lvm** rpm package be installed. This release of the LifeKeeper Logical Volume Manager Recovery Kit supports LVM version 1. The specific versions of LVM supported are those delivered by the Linux distributions.
- **LifeKeeper Software.** You must install the same version of LifeKeeper core software and any recovery kits, including the LVM Recovery Kit, and any patches on each server. Please refer to the *LifeKeeper Release Notes* for specific LifeKeeper requirements.
- **LifeKeeper for Linux Logical Volume Manager Recovery Kit.** The Logical Volume Manager Recovery Kit is provided on a CD. It is packaged, installed and removed via the Red Hat Package Manager, rpm. The following rpm file is supplied on the LifeKeeper for Linux LVM Recovery Kit CD: **steeleye-lkLVM-<Version>.rpm**

During package installation, checks are made to ensure that supported versions of both the LifeKeeper Core package and the LVM package are present on the system where the LVM Recovery Kit is being installed. The *LifeKeeper for Linux Release Notes* contains information on the required versions of these packages.

Refer to the *LifeKeeper for Linux Planning and Installation Guide* for instructions on how to install or remove the LifeKeeper Core software and the LVM Recovery Kit.

The LVM Recovery Kit must be installed on each server in the cluster on which LVM is being used to manage disk resources that are to be protected by LifeKeeper.

The LVM Recovery Kit must be installed prior to the hierarchy creation and extension of applications that sit on top of an LVM volume.

Overview

LVM Operation

LVM is currently the standard volume management product included with all of the major Linux distributions. LVM allows multiple physical disks and/or disk partitions to be grouped together into entities known as volume groups. Volume groups may then be divided or partitioned into logical volumes. Logical volumes are accessed as regular block devices, and as such may be used by file systems or any application that can operate directly with a block device.

Logical volume managers are principally used to simplify storage management. Logical volumes can be resized dynamically as storage requirements change, and volume groups and logical volumes can be sensibly named with identifiers chosen by the administrator, rather than physical disk or partition names such as **sda** or **sdc1**.

The following diagram shows the relationship of the LVM entities. File systems or applications use logical volumes. Logical volumes are created by partitioning volume groups. Volume groups consist of the aggregation of one or more physical disk partitions or disks.

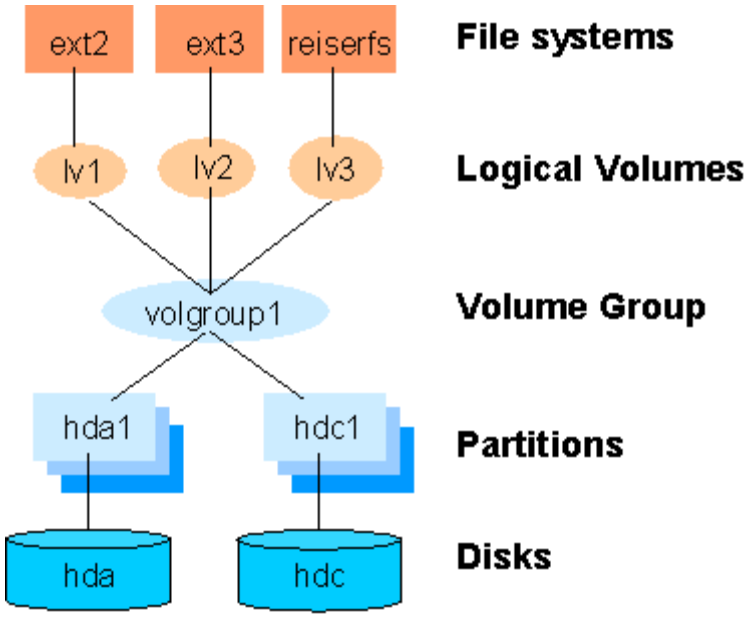

Figure 1: Logical Volume Manager entity relationships

LifeKeeper for Linux LVM Recovery Kit

The LifeKeeper LVM Recovery Kit provides the support needed to allow other LifeKeeper recovery kits to operate properly on top of Linux logical volumes. To accomplish this support, the LVM Recovery Kit installs two new resource types: **lvmlv** and **lvmvg** which correspond to logical volumes and volume groups respectively. The lvmlv and lvmvg resources exist solely for internal use so that other LifeKeeper resources can operate.

As shown in Figure 1, each volume group has one or more logical volumes that depend on it. Conversely, each logical volume must have a volume group on which it depends. A typical LifeKeeper hierarchy containing these two LVM resources looks much like the relationships shown in Figure 1. Refer to Figure 2 in the LifeKeeper LVM Hierarchy Creation and Administration section for an example of an actual LifeKeeper hierarchy.

The LVM Recovery Kit uses the commands provided by the **lvm** package to manage the volume group and logical volume resources in a LifeKeeper hierarchy. Volume groups and logical volumes are configured (or activated) when a hierarchy is being brought in-service during a failover or switchover operation, and are unconfigured when a hierarchy is being taken out-of-service.

LVM Recovery Kit Notes and Restrictions

The following notes and restrictions apply to this version of the LVM Recovery Kit.

Linux Boot Script Modifications

The Linux distributions that include LVM have also included modifications to their system boot scripts to activate LVM volume groups and logical volumes. Because LifeKeeper expects to always control the state of any volume groups and logical volumes that it is managing, the LVM Recovery Kit installation performs modifications to the system boot script to prevent it from activating volume groups and logical volumes that are controlled by LifeKeeper. The boot script is modified to call a command provided by the LVM Recovery Kit, **/sbin/vgactivate**, rather than the **vgchange** utility provided by the **lvm** package. The **vgactivate** command simply calls the **lvm vgchange** command with the appropriate arguments to individually activate all volume groups that are not under LifeKeeper control. In some recent distributions, the **lvm** package now includes a mechanism for limiting the set of volume groups to be activated at boot time, using an entry in the configuration file **/etc/sysconfig/lvm**. The LifeKeeper **vgactivate** command also checks for and honors these settings.

Support for Raw I/O and Entire Disks

While Figure 1 shows logical volumes residing below various file systems and volume groups on top of disk partitions, it is important to note that the LVM Recovery Kit can support raw access to logical volumes when used in conjunction with the LifeKeeper Raw I/O Recovery Kit, and can manage volume groups that are composed of one or more entire disks (e.g. /dev/sdc) rather than disk partitions (e.g. /dev/sdc1).

Also see the section Using LVM with LifeKeeper Data Replication for a further option in the use of LVM.

Volume Group Activation

In the current LVM 1.x implementations, when a volume group is activated, all logical volumes associated with that volume group are also activated automatically. For LifeKeeper, this means that there will be times when a logical volume is active despite the fact that its associated resource instance is still marked as being Out-of-Service (OSU). In a typical failover or switchover operation, LifeKeeper will attempt to bring the logical volumes in service immediately after the volume groups anyway, and the resulting calls to the restore script will

return immediately with a success indication. This unneeded attempt to bring the logical volumes in service has no usability impact.

LVM Version Support

As stated previously, this release of the LVM kit has been tested and is being released only against LVM version 1. Sistina recently announced the release of LVM version 2, known as LVM2. The LVM kit does not support LVM2. This restriction likely will be removed in the future, however.

LifeKeeper LVM Hierarchy Creation and Administration

LifeKeeper LVM hierarchies are created automatically during the hierarchy creation process for resources that sit on top of logical volumes. The creation and extension of hierarchies containing the LVM resource types will always be driven by the create and extend processes of a higher-level resource type, likewise the delete and unextend.

The figure below is a LifeKeeper GUI screen shot showing a complete hierarchy containing LVM resources. Note that the resources in the hierarchy are displayed by their LifeKeeper IDs for clarity, rather than the default display by tags.

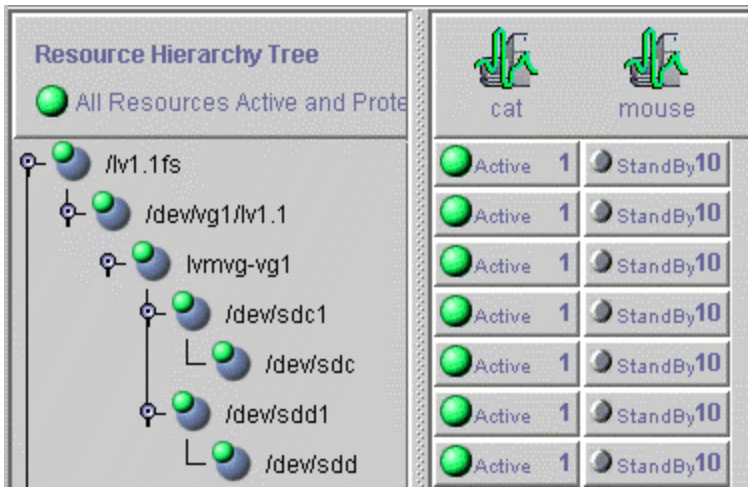

Figure 2: LifeKeeper hierarchy containing LVM resources

The hierarchy pictured in Figure 2 is a file system hierarchy, created by selecting the **File System** recovery kit under the **Edit > Resource > Create Resource Hierarchy** menu selection. It consists of a file system resource, **/lv1.1fs**, mounted on an LVM logical volume, **/dev/vg1/lv1.1**. That logical volume is a part of the **vg1** volume group, represented with the LifeKeeper ID **lvmvg-vg1**. The volume group **vg1** is composed of two physical disk partitions, **/dev/sdc1** and **/dev/sdd1**. The hierarchy also includes the underlying disk devices, **/dev/sdc** and **/dev/sdd**, below each of the disk partitions.

Hierarchy Creation Procedure

To create a hierarchy in which a file system or higher-level application uses an LVM logical volume, the following high-level procedure should be followed.

1. Determine the desired configuration of your LVM volume groups and logical volumes. In doing this, keep in mind the following points.
   - All of the disk resources associated with a given volume group must move together from one server to another in the LifeKeeper cluster.
   - All of the logical volumes associated with a given volume group (and any file systems or applications which use them) must move together from one server to another in the LifeKeeper cluster.

2. On the system which is to be the primary server for your application, create and activate the desired volume groups and logical volumes using the tools provided by the LVM package, and described in the *LVM HowTo* document referenced in the Documentation and References section above.

   If you are using shared storage, you must ensure that all physical volumes assigned to a volume group are properly shared between the machines in the LifeKeeper cluster on which you intend to run the protected application. If you intend to use LVM with LifeKeeper Data Replication, see the Using LVM with LifeKeeper Data Replication section below.

3. Create file systems on each of the logical volumes. If instead you intend to use raw I/O, bind a raw device to each of the logical volume devices.

4. Configure the protected application on the file systems, following the configuration instructions in the administration guide for the LifeKeeper recovery kit associated with the application.

5. Create and extend the application hierarchy following the instructions in the appropriate application recovery kit administration guide.

6. **IMPORTANT:** Perform manual in-service operations to temporarily move the application hierarchy to each of the cluster nodes to which the hierarchy has been extended. This step must be done once prior to any node failover operations, in order for the LVM subsystem on each cluster node to know about the configuration of the new volume groups and logical volumes. After you have performed these manual switchovers, move the application hierarchy back to the desired primary cluster node.

Using LVM with LifeKeeper Data Replication

The LVM Recovery Kit currently supports the use of LVM “above” LifeKeeper Data Replication (LKDR), but not LKDR “above” LVM. In other words, the kit can support a configuration in which the physical volume components of a volume group are LKDR devices, but it cannot support a configuration in which the source and/or target volumes of an LKDR mirror are defined as LVM logical volumes.

To build a hierarchy with LVM above LKDR, a two-phase hierarchy creation process must be used. The LKDR devices (i.e. hierarchies) must be configured using the LKDR “Data Replication Resource” option, prior to the creation of the LVM volume groups and logical volumes on the primary server. Once the desired volume groups and logical volumes have been created, the remainder of the hierarchy is created according to the configuration instructions for the recovery kit associated with the application to be protected. The resulting hierarchy will look something like the one shown in Figure 3 below.

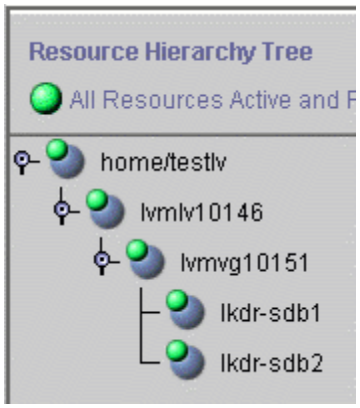

Figure 3: Hierarchy with LVM above LKDR

Volume Group Reconfiguration

One of the primary benefits of using a logical volume manager is the ability to dynamically resize logical volumes as storage requirements change. Because this may involve adding or deleting physical partitions or disks from an LVM volume group definition, the LVM Recovery Kit includes a mechanism for modifying an existing resource hierarchy to reflect such a change.

All volume group, logical volume, and file system reconfiguration should be performed outside of LifeKeeper prior to modifying the LifeKeeper hierarchy to reflect the changes. Refer to the *LVM HowTo* document referenced in the Documentation and References section for information about how this is done. If any of the steps require you to unmount or unconfigure a resource that is being protected by LifeKeeper, be sure to use the LifeKeeper GUI to do so, using the **Out of Service** operation.

To update a LifeKeeper hierarchy following these changes, first access the **Resource Properties** dialog for the modified volume group, either by right-clicking on the active volume group resource and selecting **Properties**, or by using the **Edit > Resource > Properties** menu selection and selecting the appropriate volume group resource in the **Select Resource** field. The resulting **Resource Properties** dialog should look like the one pictured in Figure 4 below, including the **Resource Configuration** button near the bottom.

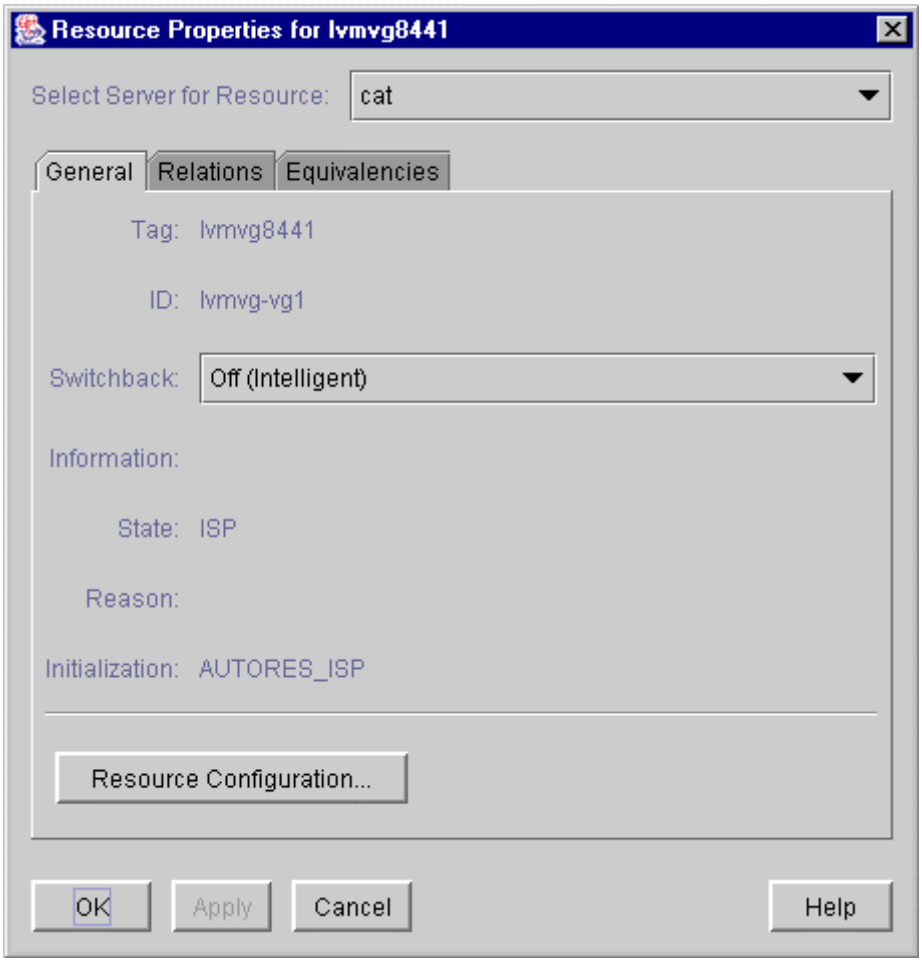

Figure 4: LVM volume group Resource Properties dialog

Clicking the **Resource Configuration** button initiates the mechanism for reconfiguring your hierarchy to reflect any modifications to the volume group resource. After a brief pause, an information box will display the volume group modifications that LifeKeeper has detected. Figure 5 below shows an example in which a single disk partition has been added to a volume group.

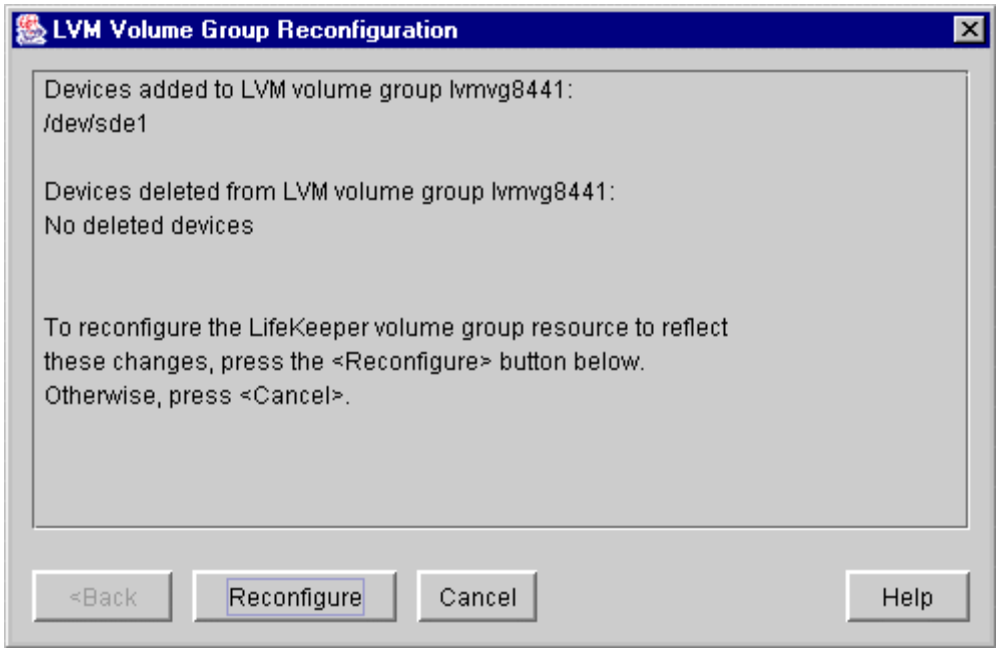

Figure 5: LVM volume group reconfiguration for added device

As stated in the information box, to reconfigure the LifeKeeper volume group to reflect the changes that have been detected, simply click the **Reconfigure** button. If you do not wish to proceed with the LifeKeeper hierarchy modification, click **Cancel**.

After clicking the **Reconfigure** button, an information box will appear, showing the progress of the reconfiguration procedure, as shown in Figure 6 below. When the process has been completed successfully, the **Done** button will become enabled. Clicking **Done** will close the information box and return you to the display of the **Resource Properties** dialog.

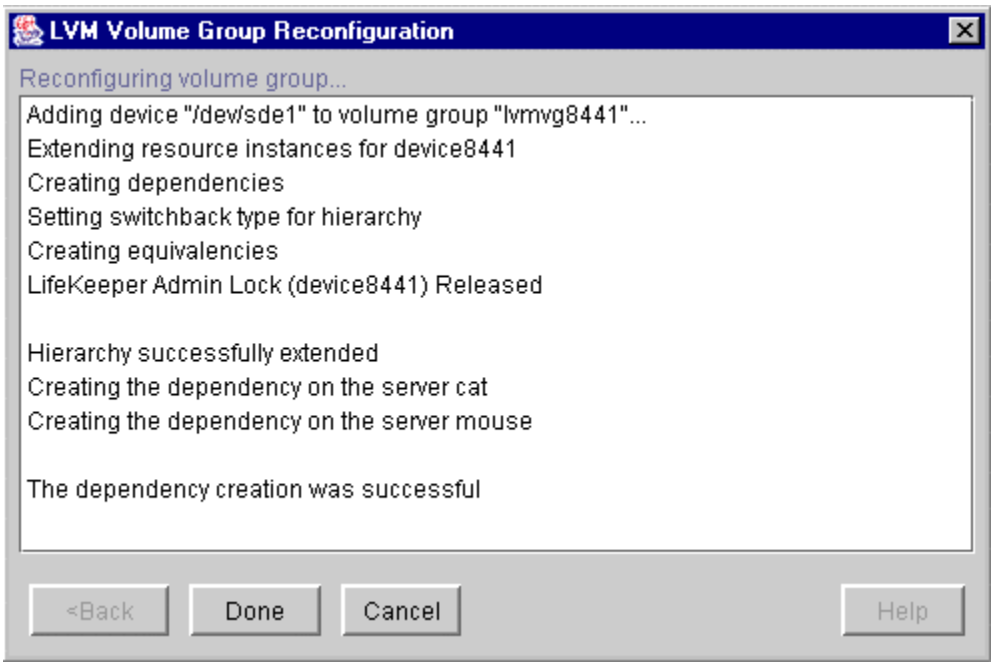

Figure 6: LVM volume group reconfiguration for added device

The following two figures show examples of the information boxes that would be displayed during the reconfiguration process when a device partition has been removed from a volume group.

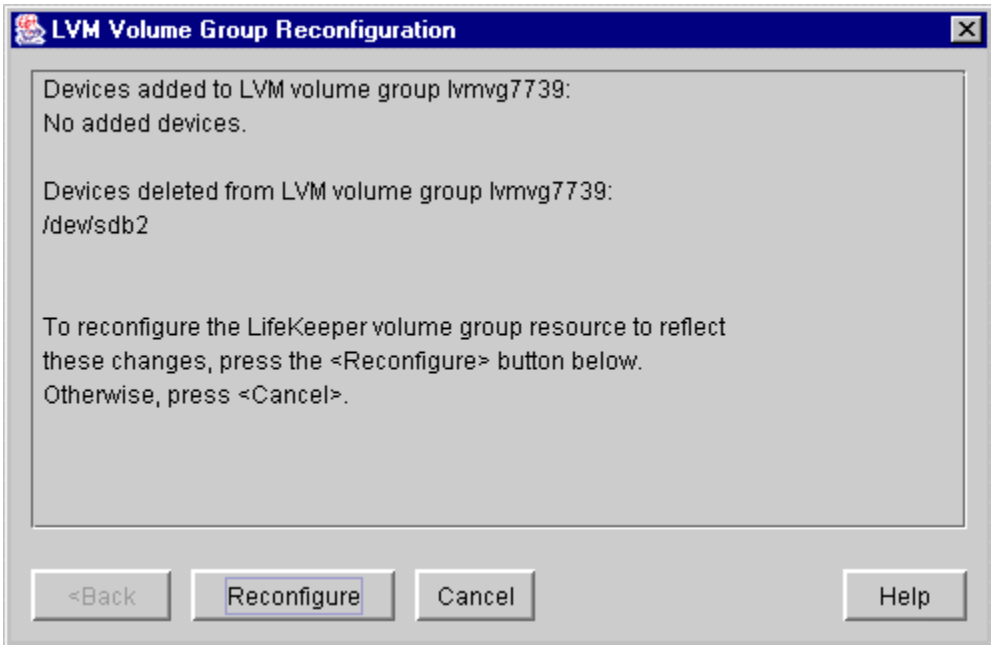

Figure 7: LVM volume group reconfiguration for deleted device

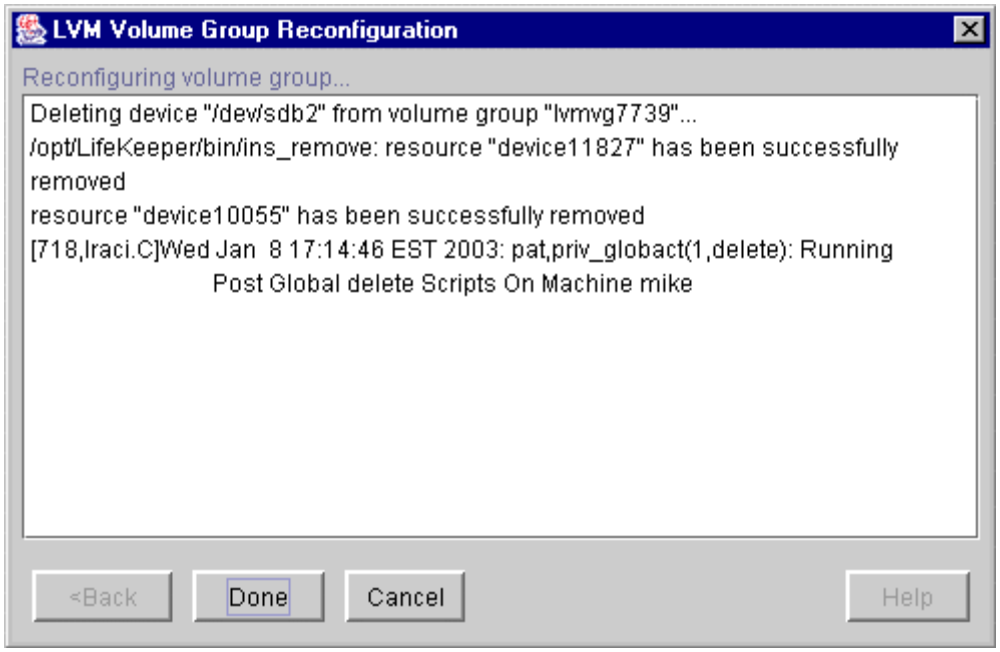
LVM Volume Group Reconfiguration
Reconfiguring volume group...
Deleting device "/dev/sdb2" from volume group "lvmvg7739"...
/opt/LifeKeeper/bin/ins_remove: resource "device11827" has been successfully removed
resource "device10055" has been successfully removed
[718,lraci.C]Wed Jan 8 17:14:46 EST 2003: pat,priv_globact(1,delete): Running Post Global delete Scripts On Machine mike
<Back
Done
Cancel
Help

Figure 8: LVM volume group reconfiguration for deleted device

Troubleshooting

Error Messages

This section provides a list of messages that you may encounter with the use of the LifeKeeper LVM Recovery Kit. Where appropriate, it provides an additional explanation of the cause of an error and necessary action to resolve the error condition.

Because the LVM Recovery Kit relies on other LifeKeeper components to drive the creation and extension of hierarchies, messages from these other components are also possible. In these cases, please refer to the documentation for the appropriate LifeKeeper component.

Messages in this section fall under these topics:

- Common Error Messages
- Hierarchy Creation
- Hierarchy Extension
- Hierarchy Restore
- Resource Monitoring
- LVM Recovery Kit Error Messages

Common Error Messages

Error Number	Error Message
000002	Usage error
000010	Error getting resource information
000011	Both Tag and ID name not specified
000019	Resource not found on local server
000022	END failed hierarchy <tag name> in service on server <server name>
000026	END failed ACTION for <tag name> on server <server name> due to <signal> signal

Hierarchy Creation

Error Number	Error Message
000012	Switchback type not specified
000013	Usage error
000014	Resource with either matching tag <tag name> or ID exists
000015	ins_create failed on server <server name>
000018	Error creating resource <tag name> on server <server name>
000021	Removing resource instance < tag name> from server <server name> due to an error during creation

Error Number	Error Message
000023	Error bringing resource < tag name> in service on server <server name>
000024	Failed resource creation of resource < tag name> on server <server name>
000027	Removing file system dependency from <parent tag> to <child tag> on server <server name> due to an error during creation
000028	Removing file system hierarchy <filesys tag> created by <parent tag> on server <server name> due to an error during creation
000029	Switchback type mismatch between parent <parent tag> and child <child tag> on server <server name> **Action:** Switchback mismatches can lead to unexpected behavior. You can manually alter switchback types for resources using the ins_setas command to eliminate this mismatch.
000030	create: tag name not specified or extend: tag name not specified

Hierarchy Extension

Error Number	Error Message
000003	Template resource < tag name> on server <server name> does not exist
000004	Template resource < tag name> cannot be extended to server <server name> because it already exists there
000005	Cannot access canextend script on server <server name>
000006	Cannot access extend script <path to extend> on server <server name>
000007	Cannot access depstoextend script <path to depstoexend> on server <server name>
000008	Cannot extend resource < tag name> to server <server name>
000009	Either <templatesys> or <templatetag> argument missing
000014	Resource with either matching tag < tag name> or ID exists
000015	ins_create failed on server <server name>
000018	Error creating resource < tag name> on server <server name>
000025	END failed resource extension of < tag name> on server <server name> due to a "<signal>" signal - backing out changes made to server
000030	create: tag name not specified or extend: tag name not specified

Hierarchy Restore

Error Number	Error Message
000023	Error bringing resource < tag name> in service on server <server name>

Resource Monitoring

Error Number	Error Message
000001	Calling sendevent for resource < tag name> on server <server name>

LVM Recovery Kit Error Messages

Error Number	Error Message
110000	<LVM resource type> resource type is not installed on <LifeKeeper server name>. **Action:** Install the LVM Recovery Kit on the identified system.
110001	This script must be executed on <LifeKeeper server name>.
110002	Failed to create <device name> hierarchy.
110003	Failed to create dependency <resource tag>-<resource tag> on machine <LifeKeeper server name>.
110004	LifeKeeper internal ID <resource ID> already in use.
110005	<LVM resource type> constructor requires a valid argument.
110006	Usage: adddelpv <VG tag> [addlist|dellist]
110007	WARNING: Failure in updating list of LifeKeeper-controlled volume groups (/etc/lkvgs).
110008	WARNING: The device hierarchy for <device name>, with tag <device resource tag>, cannot be extended automatically. **Action:** If the device hierarchy is not already extended, extend it using the LifeKeeper GUI. Then create a dependency from the volume group resource to the device hierarchy.
110009	Failed to create a dependency between volume group resource <volume group tag> and device resource <device tag>. **Action:** Create the dependency using the LifeKeeper GUI.